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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

April 10, 2001

Magalie R. Salas, Esq.
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: *Wireless E9-1-1 Phase II Automatic Location Identification
Requirements, CC Docket No. 94-102/*

*Ex Parte Supplemental Report of U.S. Wireless Corporation
Regarding Network-Based Enhanced Services*

Dear Ms. Salas:

In order to assist the FCC in its evaluation of available technologies to meet the E-911 Phase II mandate, and to address questions regarding the accuracy and availability of U.S. Wireless Corporation's RadioCamera™ Location Pattern Matching technology, U.S. Wireless submits herewith an *Ex Parte Supplemental Report*, which supplements our filing of November 9, 2000 and summarizes the results of an independent test of our RadioCamera™ Location Pattern Matching network, conducted March 6 – 16, 2001 for the National Emergency Number Association (NENA).

As reported in the *Report of U.S. Wireless Corporation Regarding Network-Based Enhanced Services* filed on November 9, 2000, U.S. Wireless has pioneered an advanced network-based geolocation technology that locates wireless phones and other devices without compromising accuracy in environments with heavy multipath and obstructed line of sight. Without requiring new or upgraded handsets, the RadioCamera™ system provides accurate location information for emergency purposes. The report attached to our *Ex Parte Supplemental Report* presents the results of extensive testing performed in our Seattle, Washington, network at the request of NENA. The results demonstrate that U.S. Wireless' RadioCamera™ meets the FCC mandate's requirements for accuracy and availability in a variety of environments. In summary, the U.S. Wireless RadioCamera™ network achieved location accuracies of:

- 81.2% within 100 m (67% of fixes are within 61 meters of the caller location)
- 95.3% within 300 m (95% of fixes are within 295 meters of the caller location).

Significantly, the U.S. Wireless RadioCamera™ network was observed to be closer to meeting the FCC's standard for handset-based solutions than some of the publicly-disclosed handset technologies trial results indicate. In the context of the mandated handset accuracy, U.S. Wireless' technology performed as follows:

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- 60.5% of calls within 50 m of the caller location;
- 89.7% of calls within 150 m of the caller location.

We believe that the attached trial results demonstrate that U.S. Wireless' Location Pattern Matching system currently meets and exceeds the Phase II requirements of the FCC mandate. Further developments worthy of note are:

- The maturity of the technology is demonstrated by the ease, efficiency and continuous nature of the test.
- Testing was conducted in a significant segment of the city (Seattle), and 900 miles away from our labs in a live carrier network, indicating that this is not a prototype or an experimental system.
- Results demonstrate continuous improvements in performance. Specifically, the system has previously met the accuracy requirements of the mandate, and it now exceeds those requirements.
- The accuracy of the RadioCamera™ system exceeds that demonstrated by many handset-based technologies. This is particularly significant in light of arguments that the FCC should wait for GPS handsets, which are based in part on the assumption that GPS in the handset will provide a higher degree of accuracy. We believe that the test with NENA demonstrates that our network-based system currently delivers better performance than publicly-disclosed data indicates GPS does.
- Lastly, the U.S. Wireless technology is offered as a service to wireless carriers. This eliminates the need for carriers to directly assume financial and technology risk in adopting a location technology. It further supports carriers maintaining a large installed base in one standard (e.g., TDMA IS-136) while migrating to another standard, by not requiring them to deploy a new location technology to accommodate the new standard. Our system is able to support IS-136, AMPS, and iDEN, all with the same equipment. A GSM interface is in development. Our network will be upgraded to support future location technologies as our clients, the carriers, require them. Further, shared infrastructure could prove cost effective, further reducing the cost to the carrier.

We reiterate U.S. Wireless' previously announced position in support of the mandate. We believe the implementation of Phase II location technologies will vastly enhance the current capabilities of Emergency Response Professionals nationwide, who are tasked with the challenge of quickly locating cellular 911 callers in order to provide life-saving assistance. We applaud the Commission's efforts to ensure that crucial automatic location technologies, which are available today, reach the public in a timely fashion.

April 10, 2001

We appreciate this opportunity to share information about our company, our technology, and our goal to help the Commission meet its commitment to the safety and well-being of the public at large. I hope you will concur that we have a compelling technology that is both timely and appropriate to meet Phase II of the E-911 Mandate.

Sincerely,



Patricia A. Murphy
Senior Corporate Counsel
US Wireless Corporation

Enclosure

cc: Kris Monteith
Chief, Policy Division
Federal Communications Commission

Thomas Sugrue
Chief, Wireless Division
Federal Communications Commission

Dan Grosh
Policy Division
Federal Communications Commission

Bruce Franca
Acting Chief, Office of Engineering & Technology
Federal Communications Commission

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of

Wireless E9-1-1 Phase II Automatic
Location Identification Requirements

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CC Docket No. 94-102

To the Commission:

**EX PARTE SUPPLEMENTAL REPORT OF U.S. WIRELESS CORPORATION
REGARDING NETWORK-BASED ENHANCED SERVICES**

I. INTRODUCTION

U.S. Wireless Corporation ("U.S. Wireless") submits this *Ex Parte* Report to supplement its November 9, 2000 Report Regarding Network-Based Enhanced Services, in connection with the Commission's Third Report and Order in the above-captioned matter,¹ for the purpose of assisting the Commission in its evaluation of available technologies to meet the E-911 Phase II mandate, and to address questions regarding the accuracy and availability of U.S. Wireless' RadioCamera™ Location Pattern Matching technology to meet the mandate. Attached as Appendix A hereto is a report of performance results of a recent field trial of the RadioCamera™ system which was requested and monitored by the National Emergency Number Association ("NENA").

¹ Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102, *Third Report and Order*, 14 FCC Rcd 17388 (1999)(*E911 Third Report and Order*).

As reported in the *Report of U.S. Wireless Corporation Regarding Network-Based Enhanced Services* filed on November 9, 2000, U.S. Wireless has pioneered an advanced network-based geolocation technology that locates wireless phones and other devices without compromising accuracy in environments with heavy multipath and obstructed line of sight and without requiring new or upgraded handsets.

The trial was conducted in Seattle, Washington in a challenging live RF network. The results of the independent trial, which exceeded the results of a recent carrier trial of the system in the same market, demonstrate that U.S. Wireless' RadioCamera™ meets the FCC mandate's requirements for accuracy and availability in a variety of environments, including dense urban, residential, light industrial, waterfront, and freeway environments. Following exhaustive testing of the system, NENA concluded that U.S. Wireless' E-911 solution was currently available, had demonstrated accuracy within the requirements of the FCC's E-911 Mandate, and would not require replacement of existing handsets for subscribers to benefit from emergency caller-location services.

II. SUMMARY OF MARCH 2001 SEATTLE TRIAL

A nine-day trial of the U.S. Wireless Corporation RadioCamera™ network was conducted during the period March 6 – 16, 2001 in Seattle, Washington, the location of a recent carrier trial. The objective of the field trial was to evaluate the performance of the RadioCamera™ Wireless Location Platform and to assess the suitability of the system in meeting the E9-1-1 location requirements as established by the FCC Report and Order 94-102. The trial procedures and performance analysis were monitored by NENA.

The test region included a two-square-mile area that encompassed downtown Seattle and the surrounding area. The U.S. Wireless Location Platform under test included 14 RadioCamera™ sites deployed as an independent network overlay (no integration with any carrier network was required). Testing was performed using digital handsets. Over 1,400 test calls and 16,000 locations fixes were evaluated for 9 mobile test routes and 18 fixed test points, encompassing a wide variety of operating environments.

Test results concluded that the U.S. Wireless Location Platform was able to meet FCC performance requirements with

- 67% of location fixes within 61 meters of the actual caller location,
- 95% of location fixes within 295 meters of the actual caller location.

To facilitate testing, a U.S. Wireless Mobile Test Unit was used to establish digital test calls, measure and report call events (initiations, handoffs, etc.) and measure ground truth location measurements using GPS technology augmented with a dead-reckoning system. The Mobile Test Unit was comprised of the following equipment: SAFCO WalkAbout Unit, commercial digital handset, synchronization unit, CDMA handset (used as a wireless data link to the Hub), GPS unit and a drive test vehicle equipped with a dead-reckoning system.

A set of 9 mobile test routes and 18 stationary test points was defined for the test region. The test cases were designed to provide a representative set of test points and routes throughout the test region and included both on-road and off-road testing. The 9 mobile routes provided comprehensive coverage of the test area: 7 routes were selected as regional tests (confined to specific areas within the test region), the 8th route was defined as a freeway route and the 9th route was selected in a random fashion throughout the test region.

All test calls were 30 seconds in length with 15 seconds between consecutive test calls. At each stationary test point, approximately 40 test calls were placed. For each mobile test route, approximately 100 test calls were placed during each route, except for the two routes in the same geographical area in which ~50 calls were placed for each. The RadioCamera™ system was configured to produce a location estimate every 3 seconds throughout a test call. During testing two sets of data files were collected and stored: RadioCamera™ Hub Playback files containing a record of the RadioCamera™ location measurements produced in real-time and Mobile Test Unit files including the GPS / dead-reckoning log files where the ground truth measurements were recorded.

Accuracy performance was computed by comparing the RadioCamera™ location measurements with “ground truth” measurements made by the Mobile Test Unit. Performance was characterized in terms of the FCC performance metrics of 67th and 95th percentiles. The following 3 cases were evaluated for each mobile route and test point:

- *All Fixes*: accuracy for all location fixes, 100% yield where no fixes are discarded, regardless of fix or call quality, ~10 fixes/call (one fix every 3 seconds, for each 30-second call);
- *First Fix*: accuracy for the first fix of each call, 1 fix/call, reported within ~3.2 seconds, indicative of call routing accuracy;
- *Best Fix*: accuracy for the highest quality fix during each call, 1 fix/call, chosen as the fix with the highest associated quality factor, reported within 30 seconds as per the FCC recommendations.

The overall system performance for the combined 9 mobile test routes and the 18 stationary test points with a distribution of roughly 50% mobile and 50% stationary test calls is provided in Table 1.

Table 1: Overall Performance Summary for all stationary and mobile test cases.

	# of Calls	# of Fixes	m@67%	m@95%	%<100m	%<300m
Best Fix	1481	1481	61m	295m	81%	95%
First Fix	1481	1481	60m	364m	79%	94%
All Fixes	1481	16066	62m	348m	81%	94%

Based upon FCC recommendation for best fix accuracy within 30 seconds, the US Wireless Location Platform was determined to be FCC-Compliant for a network-based solution.

- 81.2% within 100 m (67% of fixes are within 61 meters of the caller location)
- 95.3% within 300 m (95% of fixes are within 295 meters of the caller location)

The US Wireless Location Platform was also seen to be close to meeting the FCC's standard for handset-based solutions:

- 60.5% of calls within 50 m of the caller location;
- 89.7% of calls within 150 m of the caller location.

The results of the trial were also significant because most of the points selected were within the test region and U.S. Wireless added neighbor lists to the system. Neighbor lists are a proxy for the cell sector information that a carrier would be expected to provide pursuant to the mandate. It is expected that performance of the system will be even higher when standardized cell sector information is available from the carriers.

Contrary to broad generalizations often made regarding network-based systems, the RadioCamera Location Pattern Matching technology does not rely on triangulation and is able to locate wireless callers from a single point of reference or base station. The RadioCamera system

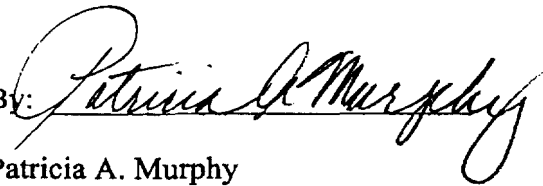
supports the wireless standards of AMPS, TDMA, CDMA, and iDEN, and a GSM interface is currently being developed.

III. CONCLUSION

Five years ago, it was the promise of the Mandate to increase levels of personal safety and security and to facilitate the work of the Public Safety community by providing the tools to more effectively respond to crisis situations. The attached report confirms that technology to implement Phase II E9-1-1 exists today. U.S. Wireless again respectfully urges the Commission to remain steadfast in enforcing the original terms of the Enhanced 9-1-1 Phase II requirements.

Respectfully Submitted,

U.S. Wireless Corporation

By: 

Patricia A. Murphy
Senior Corporate Counsel
U.S. Wireless Corporation
2303 Camino Ramon, Suite 200
San Ramon, CA 94583
925-327-6200
Facsimile: 925-830-8821
Email: pmurphy@uswcorp.com

April 10, 2001



USWC RadioCamera™ Seattle Field Trial: Performance Results

Testing Monitored by NENA

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EXECUTIVE SUMMARY

A nine-day trial of the US Wireless Corporation RadioCamera™ network was conducted in Seattle, WA during the period 06-16 March 2001. The objective of the field trial was to evaluate the performance of the RadioCamera™ Wireless Location Platform and to assess the suitability of the system in meeting the E9-1-1 location requirements as established by the FCC Report and Order 94-102. The trial procedures and performance analysis were monitored by NENA¹.

The test region included a 2 square mile area that encompassed downtown Seattle and the surrounding area. The US Wireless Location Platform under test included 14 RadioCamera™ sites deployed as an independent network overlay (no integration with any carrier network was required). Testing was performed using digital handsets. Over 1,400 test calls and 16,000 locations fixes were evaluated for 9 mobile test routes and 18 fixed test points, encompassing a wide variety of operating environments.

Test results concluded that the US Wireless Location Platform was able to meet FCC performance requirements with

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To facilitate testing, a US Wireless Mobile Test Unit was used to establish digital test calls, measure and report call events (initiations, handoffs, etc.) and measure ground truth location measurements using GPS technology augmented with a dead-reckoning system. The Mobile Test Unit was comprised of the following equipment: SAFCO WalkAbout Unit, commercial digital handset, synchronization unit, CDMA handset (used as a wireless data link to the Hub), GPS unit and a drive test vehicle equipped with a dead-reckoning system.

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¹ National Emergency Number Association

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The US Wireless Location Platform was also seen to be close to meeting the FCC's standard for handset-based solutions:

- 60.5% of calls within 50 m of the caller location;
- 89.7% of calls within 150 m of the caller location.

1 INTRODUCTION

This report provides final results and performance analysis of the US Wireless Corporation Field Trial of the RadioCamera™ Wireless Location System. Testing was conducted for nine days during the period 06-16, March 2001, in an approximately 2 square mile test region including downtown Seattle, Washington. Personnel from NENA monitored test procedures and system performance.

The primary objective of the field trial was to evaluate the performance of the RadioCamera™ Wireless Location Platform and to assess the suitability of the system in meeting the E-911 location requirements as established by the FCC Report and Order 94-102. In order to fully evaluate the network, a comprehensive test plan was developed to evaluate system performance under a variety of controlled test conditions and operating environments. Testing included in-vehicle and pedestrian test cases, as well as stationary and mobile test cases. For each test case, a sufficient number of calls and location fixes were recorded to ensure statistical reliability of the measured performance results.

The remainder of this report is organized as follows. In Section 2, the test methodology is described, including a description of the test region, the RadioCamera™ test system, and all test procedures. The test cases, maps of stationary test points and mobile routes, are provided in Section 3 and a description of the performance analysis is given in Section 4. Comprehensive performance results are presented in Section 5, followed by conclusions in Section 6. Appendix A provides an overview of the US Wireless Location Services Platform and describes the RadioCamera™ location –pattern matching technology.

2 TEST METHODOLOGY

2.1 Test Region

The trial test region is shown in Figure 1. The test region covers approximately 2 square miles and includes a variety of operating environments including dense urban, urban, commercial, residential, waterfront and highway.

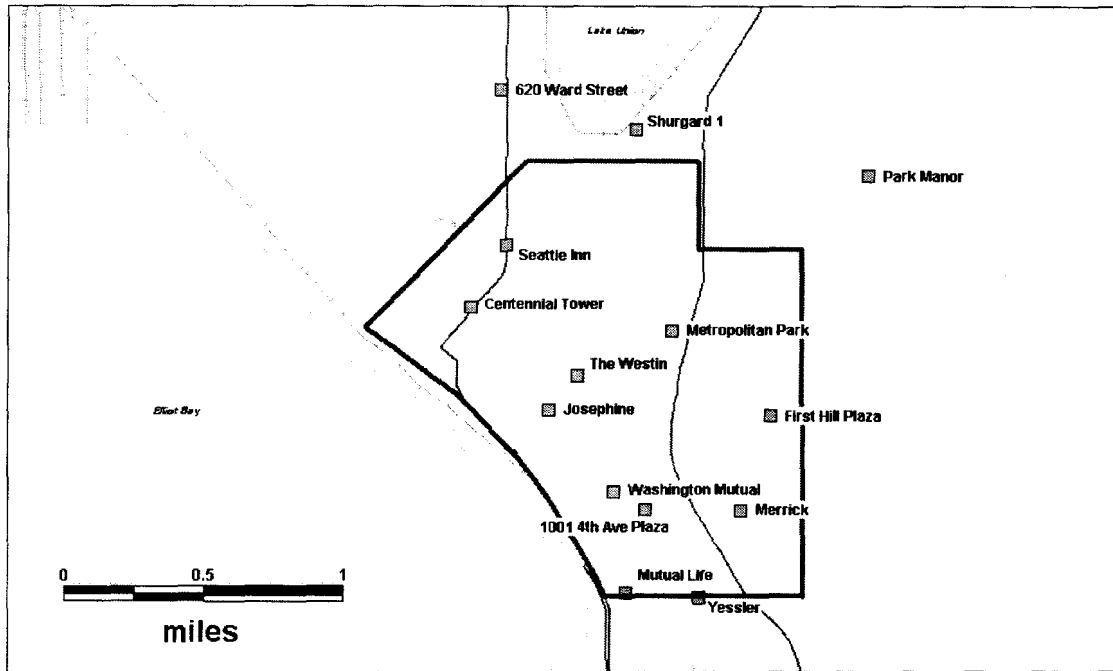


Figure 1: Field Trial test region. Coverage area is approximately 2 square miles.

2.2 Test System

The Test System was comprised of two primary components: (1) the RadioCamera™ Location Network, and (2) the Mobile Test Units.

2.2.1 RadioCamera™ Location Network

The RadioCamera™ Location Network included a set of 14 RadioCamera™ Base Units (RBUs), a RadioCamera™ Hub, and the data network required for communications between these systems. The locations of the RBUs are shown in Figure 1. A single RadioCamera™ Hub was deployed at the US Wireless office located in Seattle, WA.

Leasing considerations motivated the deployment of the Seattle test region. The goal was to have an operational network in a timely manner. In a commercially deployed RadioCamera™ network, sophisticated RF engineering techniques and knowledge of a carrier's sites are combined for site selection with the goal of approximately 1:1 with a carrier's sites. Commercial RadioCamera™ networks will be deployed for the most advantageous coverage of all carriers in a market and network modifications will be made as new carrier sites are deployed.

The individual RBUs reported their location information through either a 56k point-to-point frame relay or a wireless microwave link. From these sites, all RBU communications were connected to the RadioCamera™ Hub through dedicated 128K frame-relay circuits. Wireless microwave links were used to increase the speed of deployment and are currently being converted to frame relay circuits. Commercial networks will utilize 128k or larger frame relay circuits for all transfer of data from the RBU to the Hub.

2.2.2 Mobile Test Unit

The Mobile Test Unit (MTU) was responsible for establishing digital test calls, measuring and reporting all call events (*e.g.*, call initiations, handoffs, and terminations), and establishing the ground truth location measurements for mobile calls. The MTU consists of the following equipment:

- SAFCO Walkabout Unit – extracts call event information from the test handset and provides this information to the Laptop Computer;
- Digital Handset – a conventional dual-mode handset used for placing all test calls (placed in digital only mode);
- Synchronization Unit – measures timing for active test calls. This unit consists of two components: (1) an RF power envelop detector and (2) a GPS timing source;
- CDMA Handset – provides a wireless data link between the MTU and the Hub, for reporting all call event information and timing to the Hub in real-time;
- GPS Unit – commercial GPS unit to provide ground truth latitude & longitude, as well as GPS timestamps;
- Laptop Computers – MTU control and processing;
- Drive-Test Vehicle – vehicle equipped with a dead-reckoning system to supplement GPS.

Two independent mobile test units were used in testing. One was fully equipped as described above, while a second was designed for use outside of the vehicle for off-road and indoor testing.

3 TEST CASES

A set of 18 Stationary Test Points and 9 Mobile Test Routes was defined for the nine-day evaluation period. The test points and routes were designed to evaluate the system over a wide range of operating conditions and environments.

The locations of the 18 Stationary Test Points are shown in Figure 2. Note that 2 out of 18 Stationary Test Points (Points 6 and 7) are located outside of the designated test region and may not accurately reflect the RadioCamera™ network's performance. The RadioCamera™ network was designed and optimized for performance within the test region. Performance outside of the test region for any location system will be unpredictable.

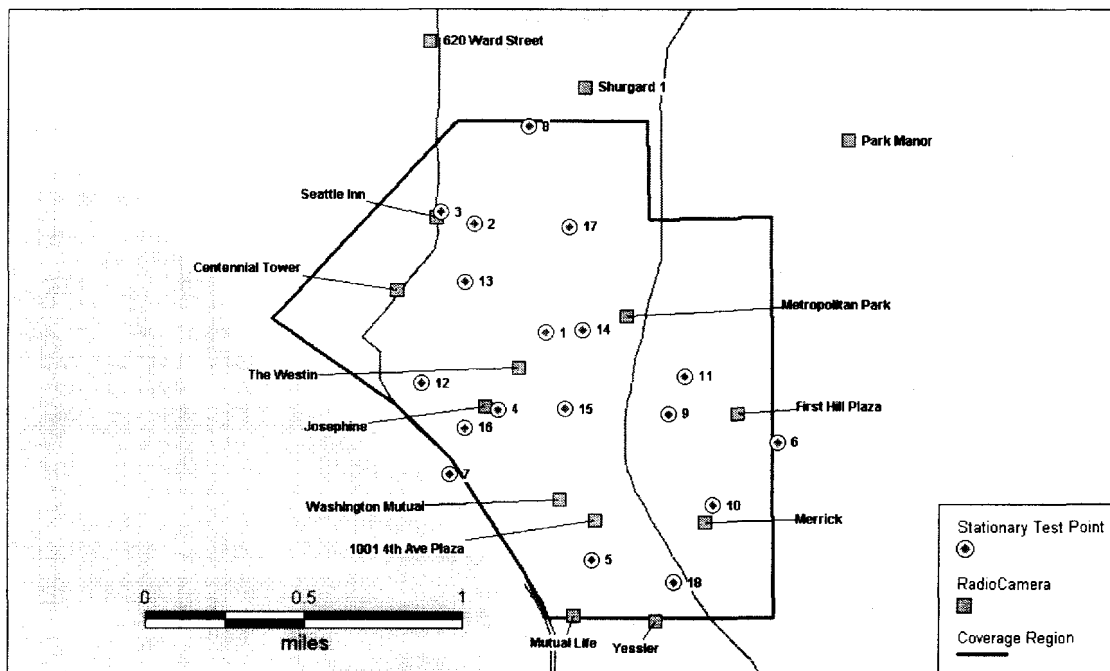


Figure 2: Stationary Test Points.

The nine Mobile Test Routes are shown in Figure 3-Figure 11. Mobile Test Routes 1 through 7 test specific regional areas and were selected for ubiquitous testing of the coverage region. Mobile Route 8 demonstrates highway performance. Mobile Route 9 was chosen to illustrate performance throughout the test region.

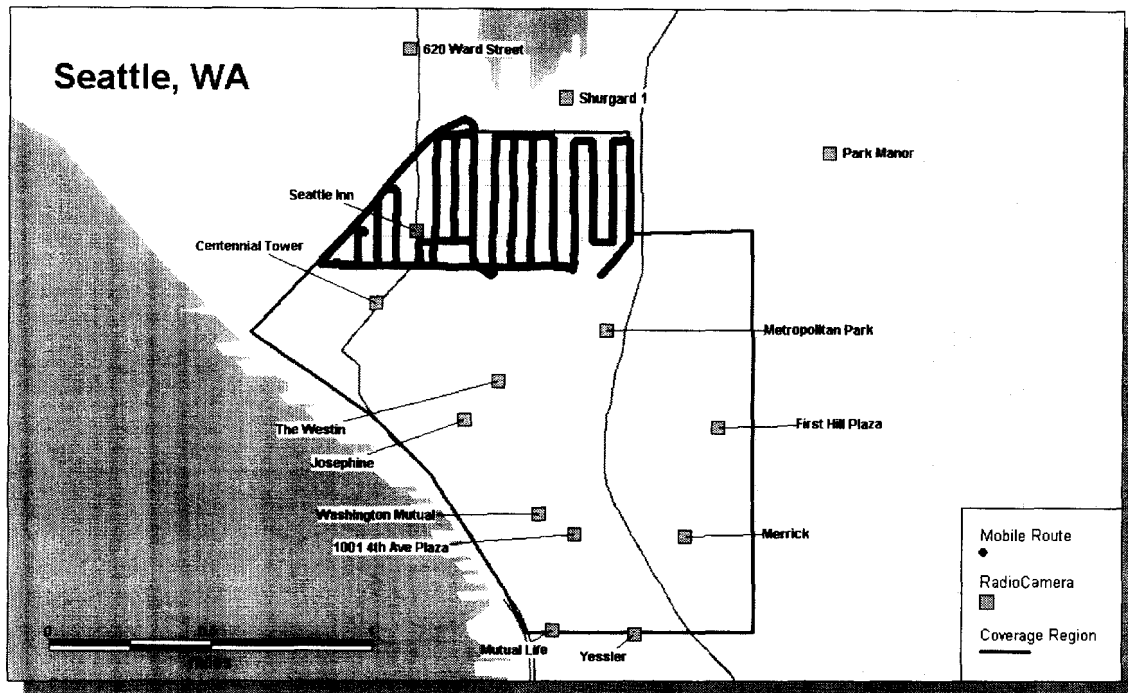


Figure 3: Mobile test route 1 (M1), North Route, driven north and south.

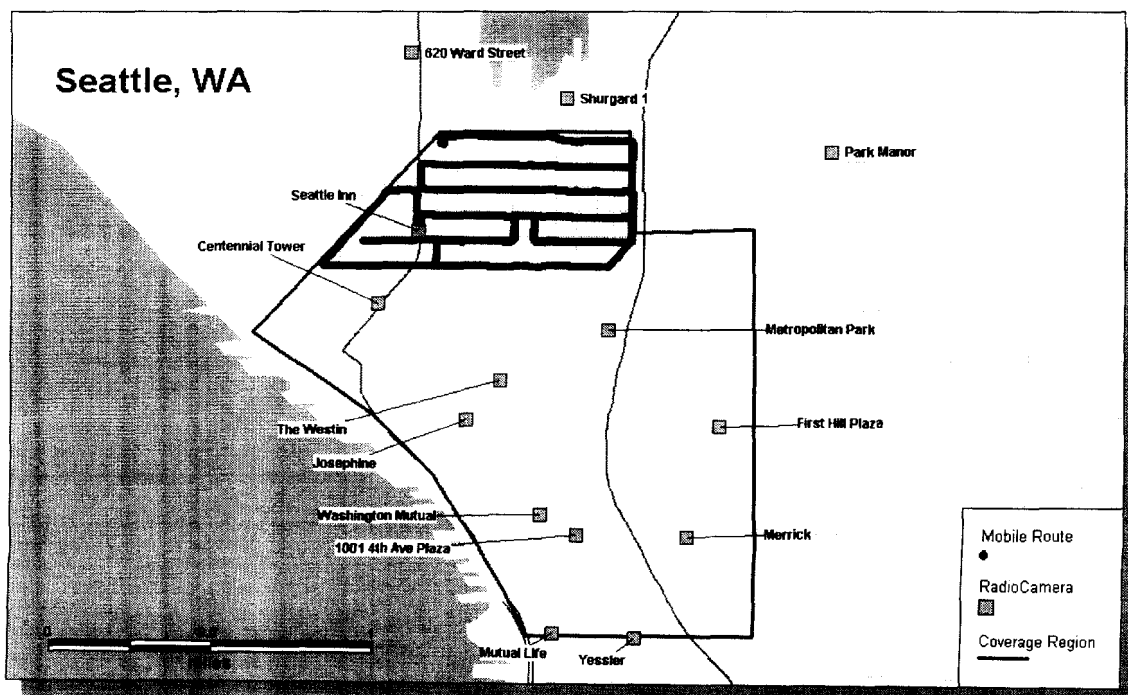


Figure 4: Mobile test route 2 (M2), North Route, driven east and west.

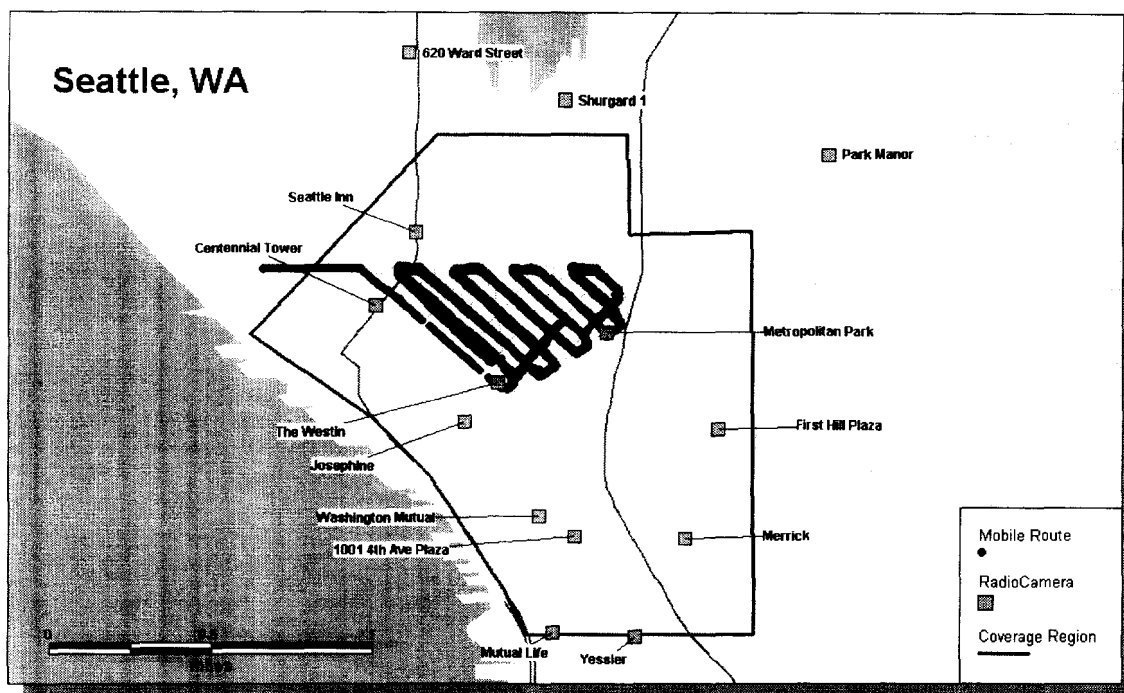


Figure 5: Mobile test route 3 (M3), North-Central Route.

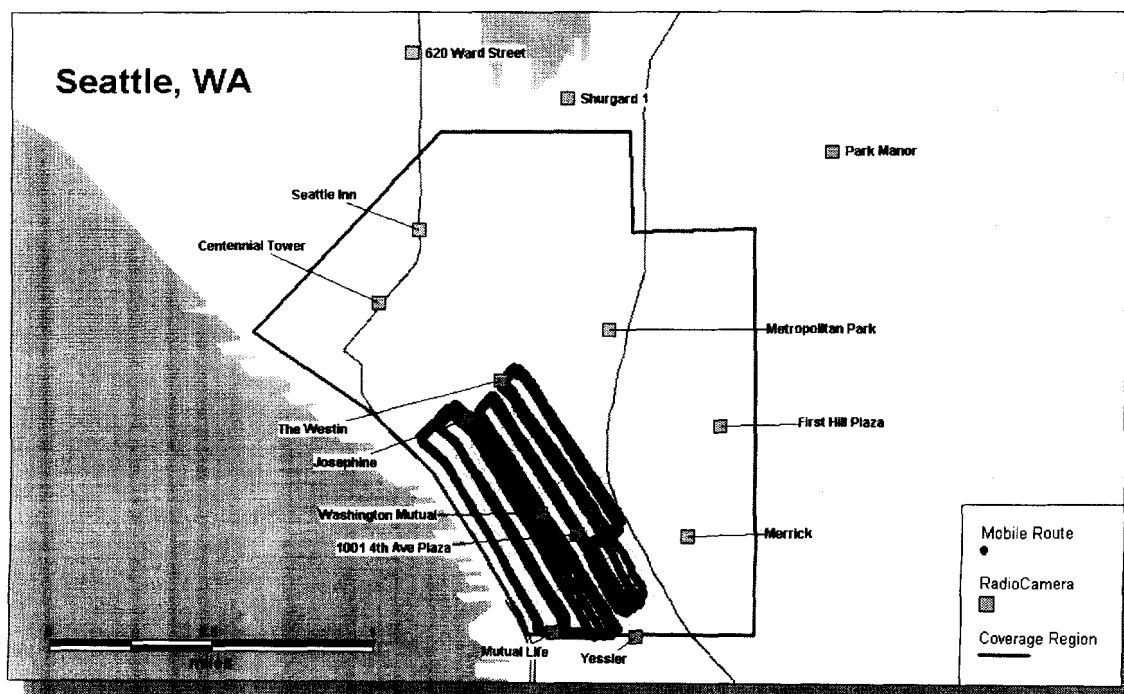


Figure 6: Mobile test route 4 (M4), Downtown Route.

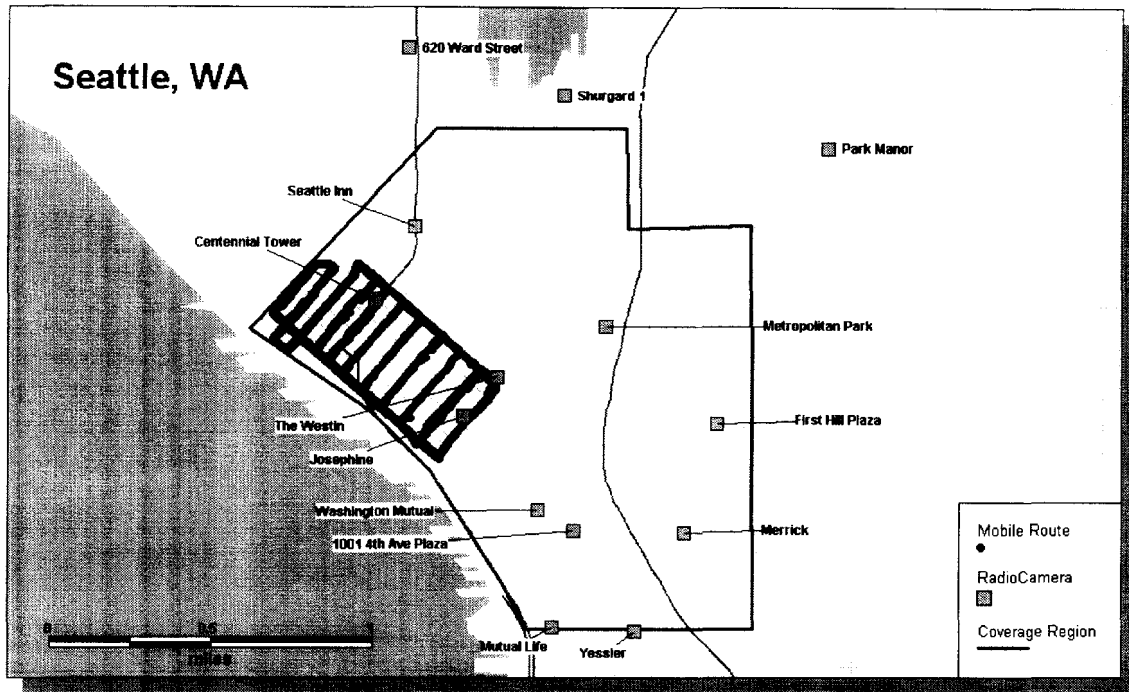


Figure 7: Mobile test route 5 (M5), Western Route.

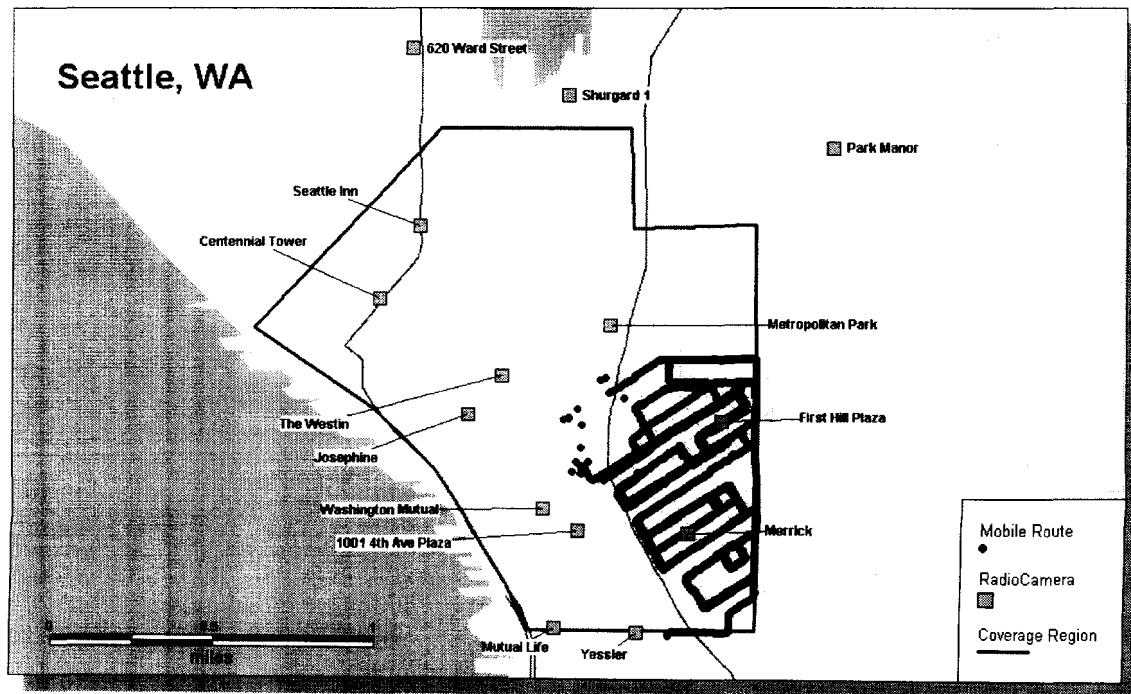


Figure 8: Mobile test route 6 (M6), East Route.

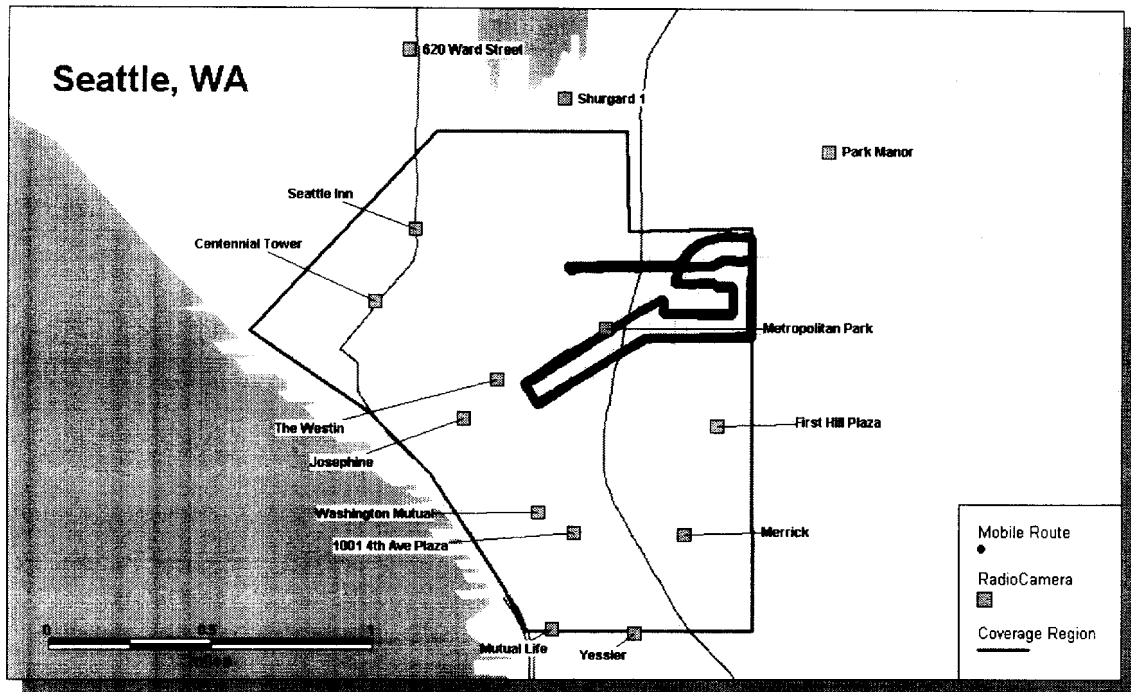


Figure 9: Mobile test route 7 (M7), Convention Center Route.

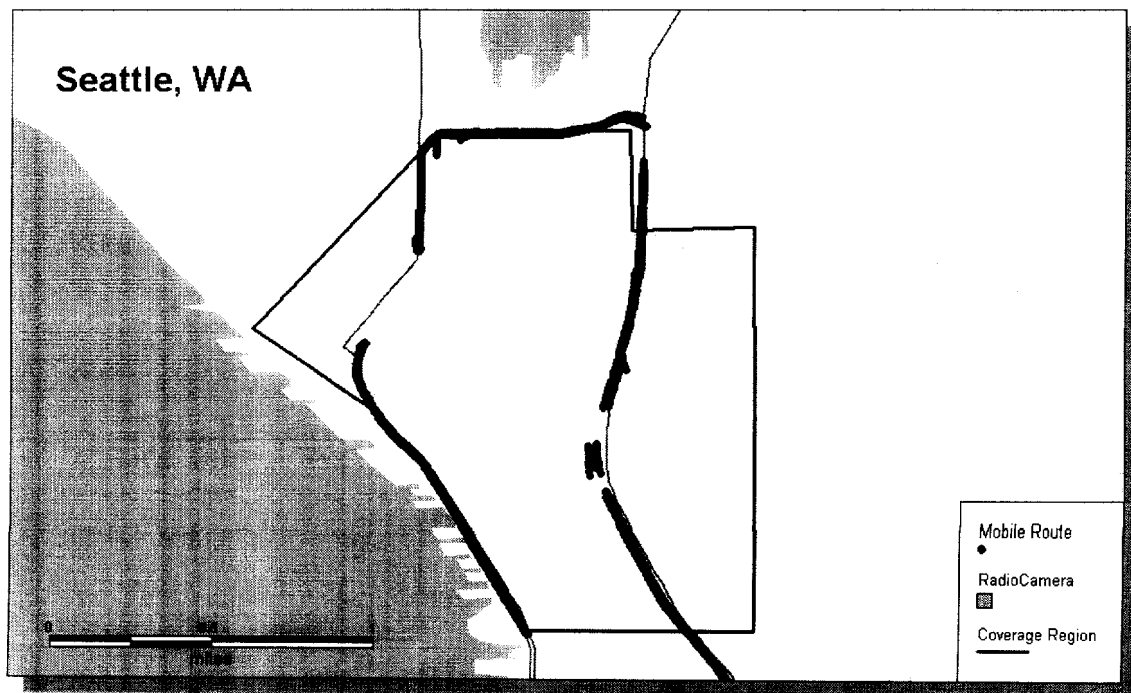


Figure 10: Mobile test route 8 (M8), Freeway Route.

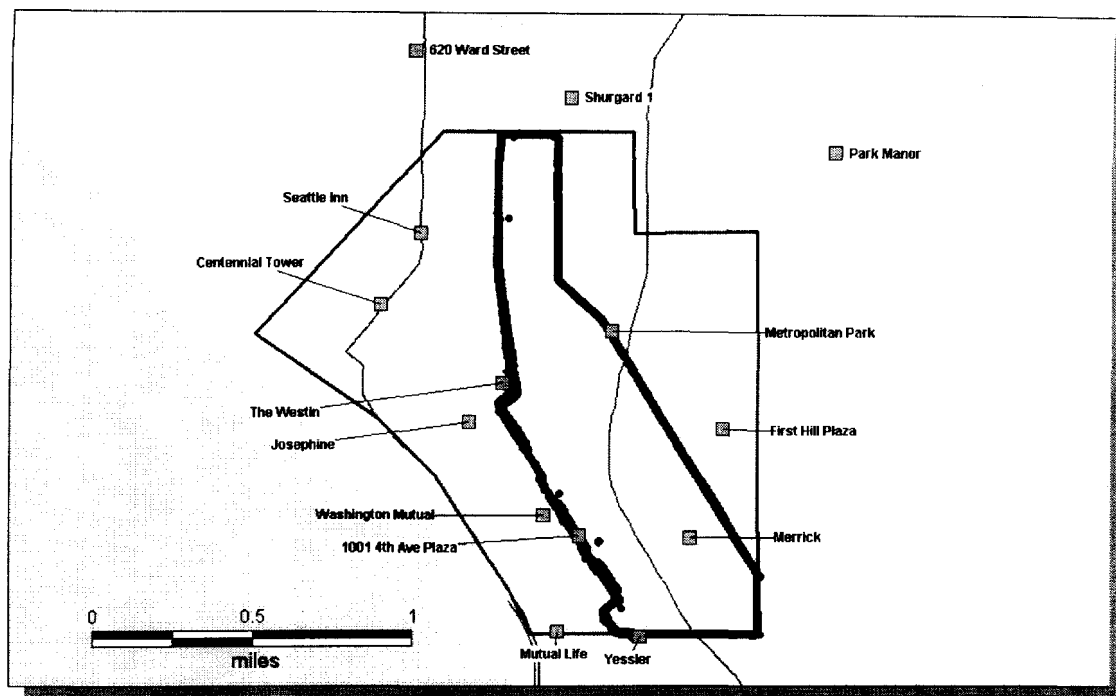


Figure 11: Mobile test route 9 (M9), Overall Test Region Route.

3.1 Test Procedures

3.1.1 Test Teams

The test procedures were executed by two test teams. One team was referred to as the “Field Test Team”. This team was responsible for placing all calls and making measurements at the designated Stationary Test Points and Mobile Test Routes. A second test team was referred to as the “Observation Team”, and was located at the RadioCamera™ Hub in the Seattle, WA office of USWC.

The team composition and company affiliations were as follows:

Field Test Team (single team of 3 persons)

- Vehicle Driver, USWC
- Mobile Test Unit Technician, USWC
- Field Test Observer(s), NENA

Observation Team (single team of 3 persons)

- RadioCamera™ Hub Operator, USWC
- USWC Test Coordinator, USWC
- NENA Test Coordinator, NENA